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Interactive comment on "Scars in the Abyss: Reconstructing sequence, location and temporal change of the 78 plough tracks of the 1989 DISCOL deep sea disturbance experiment in the Peru Basin" *by* Florian Gausepohl et al.

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Line 12:

(1) BIE's were only the US, Japanese, IOM and Indian Experiments - DISCIOL was a Re-colonization experiment and differed in the impact of the disturbance on the benthic community and did not target the impact of the created plume. Because of financial constraints DISCOL was not able to focus on this important aspect. Both experiments complement each other but are not at all comparable in their results.

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Discussion paper

(2) We thank the reviewer for this valuable comment to clearly differ between the terms BIE and Recolonization Experiment, which is the right term for this DISCOL case, as the comment author points out. We changed the nomenclature here and in the other cases appearing in the manuscript.

(3) lines 11-13: High-resolution optical and hydroacoustic seafloor data acquired in 2015 enabled the reconstruction of disturbance tracks of a past deep- sea re-colonization experiment that was conducted in 1989 in the Peru Basin during a German environmental impact study associated with manganese nodule mining.

Line 38:

(1) Literature recommendation

(2) We have looked in the pointed out paper and implemented it in the citation list since it points out another kind of manganese nodules as hard substrate habitat, which should definitely be named here.

(3) Line 38: Besides the removal of the Mn nodules as an important hard-substrate habitat on the abyssal plains (Purser et al., 2016; Vanreusel et al., 2016, Thiel et al. 1993), the mining activities will completely re-work the top sediment layers and re-suspend large amounts of sediment into the water column.

Line 46:

(1) See comment 1.

(2) We changed the used term “BIE” to the correct one “Recolonization Experiment.

(3) To evaluate these effects on the environment, several benthic impact experiments (BIE) and one Recolonization Experiment, the German Research Project “Disturbance and Recolonization Experiment-DISCOL” (http://www.discol.de), have been conducted in the past within different large Mn-nodule areas, including the Peru Basin (Thiel and Schriever, 1989), the Central Equatorial Pacific (e.g. Burns, 1980; Fukushima, 1995)

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or the Indian Ocean Basin (Desa, 1997).

Line 70:

(1) Results of a monitoring were presented by Hessler during the International deep sea biology Conference at Hamburg. He told about the uncertainties of the results because they had not control of the sampling area and if they really hit the impacted areas or how close they were to the tracks or even inside the tracks. (personal communication with Hessler).

(2) The Deep Sea biology conference in Hamburg was in 1985. During the recovery studies from 2004 from the research expedition “NODINAUT” (RV “L’Atalante”, IFREMER) the disturbance track was located and samples were taken within and close to the tracks as well as in reference areas. The submersible “NAUTILE” was used for sampling the tracks to ensure the correct positioning of the in-track samples (Miljutin et al. 2011). Hence the results cited here are plausible to us.

Line 74:

(1) All these experiments and monitoring efforts were based on small scale disturbances - maximum length of mining tracks 1.5 km, maximum width 4.5m. Based on Hessler’s presentation at the International deep sea biology conference the DISCOL project was developed as the first large scale experiment in the deep sea ever! See also Thiel et al. 1998, Environmental risks from large-scale ecological research in the deep-sea: a desk study. Contract No. MAS2-CT94-0086, Commission of the European Communities, Directorate General for Science, Research and Development, Brussels, 210pp.)

(2) It is true that the scale of the DISCOL experiment is unique and the other listed experiments are not comparable in scale. They were named “large-scale” benthic experiments to point out the comparably large gear that were used for the disturbances and to mark the difference to comparable small-scaled disturbances created by other

devices, such as dredges or fish trailing marks for example. In 2015 a small disturbance experiment was conducted where the sediment plume was created by the tow of an epibenthic sledge (Peukert et al. 2018). To point out that we exclude these kind of minor experiments we used the term “large-scale BIE’s”. To highlight the size of the DISCOL experiment we changed the sentence in lines 74-75.

(3) lines 74-75: Chronologically the next and largest ever created disturbance was conducted in the DISCOL Experimental Area in the Peru Basin.

Line 87:

(1) Add large scale.

(2) We added as suggested.

(3) Line 87 ff.: Again north of the equator, the first large-scale benthic disturbance experiment in the eastern Clarion-Clipperton Fracture Zone (CCFZ) conducted by the United States was the Benthic Impact Experiment II (BIE-II) in 1993, using the “Deep Sea Sediment Resuspension System” (DSSRS) (Brockett and Richards, 1994; Tsurusaki, 1997) as disturbance tool (Trueblood and Ozturgut, 1997).

Line 112:

(1) The right name is Kotlinski and Stoyanova.

(2) The spelling of the names has been corrected.

(3) line 112 ff.: In 1995, the InterOceanMetal (IOM) Joint Organization conducted a benthic disturbance experiment (IOM-BIE) over an area of 2000 x 1500m also in the eastern CCFZ, once more using the DSSRS (Kotlinski and Stoyanova, 1999; Radziejewska, 2002).

Line 131:

(1) Please see comment on page 3 - the activities in the late 70’s were pre-pilot mining

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Discussion paper

test, what means industries tested the developed miners or components of these.

(2) The comment has been considered and the text was adapted accordingly.

(3) Line 131 ff.: Reviewing the different large-scale BIEs and pilot mining tests conducted between the late 70's and late 90's it becomes obvious that the different experimental setups and the missing uniform definition of 'a' plume (grain size distribution, flocculation behavior, total mass per liter, settling velocity etc.) make it impossible to use the presented information for a meaningful predict of the behavior of a sediment plume created during a real deep sea mining operation (Peukert et al., 2018).

Line 162:

(1) 4 weeks only! from the end of February to 3rd week of March - please see Cruise report

(2) The time span has been corrected to 4 weeks. The period of two months includes the pre-baseline studies and the first impact studies right after the disturbance, but the disturbance phase itself lasted only 4 weeks, as the reviewer pointed out.

(3) line 162 ff.: Although the 78 plough tracks were created over a period of 4 weeks (Thiel and Schriever, 1989) a more detailed understanding of their sequence is relevant regarding faunal differences from within or close to plough tracks in strong or weaker disturbed parts of the DEA as well as for understanding varying down-core geochemical gradients that are effected by the thickness of the resettled sediment, the "blanketing" (Thiel, 2001; Boetius, 2015).

Line 179:

(1) Please add papers of Bluhm.

(2) Bluhm indeed provided valuable information here and has therefore been added to the citation list.

(3) lines 175-179: Until 2015, the location and path of the disturbance tracks as well

as the position of video and photo material of the past OFOS (Ocean Floor Observation System) surveys only existed as a vast collection of analogue (i.e. cruise reports, printed large navigational charts, video cassettes and slide films) and some digital records (i.e. OFOS annotation files, sample analysis as text or EXCEL files, e.g. Bluhm, 1994, Bluhm and Thiel 1996, Thiel and Schriever 1989, Schriever 1990, Schriever and Thiel 1992, Schriever et al., 1996).

Line 207:

(1) cite Bluhm

(2) The missing literature source was added.

(3) lines 206-209: Additional visual investigations during all cruises to the DEA were conducted using the towed camera system OFOS either equipped with both a still and video camera (Bluhm and Thiel, 1996, Thiel and Schriever, 1989; Schriever, 1990; Schriever and Thiel, 1992; Schriever et al., 1996) or just a video camera, which was mounted on the frame of a sampling device (Boetius, 2015; Greinert, 2015).

Line 353:

(1) This is OK, the tests of the 16m wide plow harrow was done outside of the DISCOL Area! Three or 4 tracks were done only. Handling of the 16m wide plough harrow on board of the ship was extremely difficult and took too much time.

(2) There was a misunderstanding in the time when the width of the plough harrow was halved. Since the focus here is on the DISCOL Area the 16 m are not considered. The manuscript has been adjusted to that.

(3) Line 354-356: Each track was assumed to have a width of 8 m, not considering the possible handling problems with the plough-harrow (e.g. being towed only on the side, short loss of bottom contact ,Thiel and Schriever, 1989)

Line 385:

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Discussion paper

(1) These investigations were no BIEs - they were a kind of monitoring of the impact of the pre pilot mining tests.

(2) The passage was corrected and the correct term was implemented.

(3) With regards to other impact monitoring results from large-scale disturbances (e.g. Lavelle et al., 1981, Table A1) and the results of small-scale disturbance experiments conducted during SO239 (Martinez Arbizu and Haeckel, 2015; Peukert et al., 2018), SO242/1 (Greinert, 2015), and SO242/2 (Boetius, 2015), the maximum distance affected by sediment blanketing was assumed to be 120 m with, and 20 m against the current direction for the “strong” current regime.

Line 410:

(1) please delete

(2) The passage has been corrected.

(3) The final blanketing map was produced by adding all relative sediment thicknesses within each square meter of the DEA area using the blockmean command in GMT (argument –Ss to get the sum; Wessel et al., 2013) and producing an interpolated grid using the nearneighbor command.

Line 596:

(1) The DiSCOL Area was visited 6 months (SO64) or three years (SO77) after the impact - not 1 year!

(2) This has been corrected. The cruise SO64 took place in autumn 1989, not in 1990. The Figure 12C was adapted accordingly.

(3) Half a year later, the track is distinctly smoothed and covered by sediment (Figure 12C) due to the re-settled sediment from plough deployments PFEG 4 to 11.

References Miljutin, D. M., Miljutina, M. A., Arbizu, P. M. and Galéron, J.: Deep sea

nematode assemblage has not recovered 26 years after experimental mining of polymetallic nodules (Clarion-Clipperton Fracture Zone, Tropical Eastern Pacific), Deep. Res. Part I Oceanogr. Res. Pap., 58(8), 885–897, doi:10.1016/j.dsr.2011.06.003, 2011.

Peukert, A., Schoening, T., Alevizos, E., Köser, K., Kwasnitschka, T., Greinert, J.: Understanding Mn-nodule distribution and evolution of related deep-sea mining impacts using AUV-based hydroacoustic data, Biogeosciences 15, 2525-2549, https://doi.org/10.5194/bg-15-2525-2018, 2018.

Please also note the supplement to this comment:
https://www.biogeosciences-discuss.net/bg-2019-348/bg-2019-348-AC2-supplement.pdf

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